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CARNIVOROUS PLANT NEWSLETTER

VOLUME 16, Number 4 DECEMBER 1987

CARNIVOROUS PLANT NEWSLETTER

Official Journal of the
International Carnivorous
Plant Society

Volume 16, Number 4
December 1987

Front cover: *P.* X "Sethos" *(P. caudata* X *P. ehlersae)* is a very vigorous grower and produces abundant flowers was produced by Harald Weiner of West Germany in 1981. Photo by Chuck Powell, II.
Back cover: *P. gypsicola* painted by R. Scott Bennett.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to ICPS c/o Fullerton Arboretum, CSUF, Fullerton, CA 92634. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to ICPS.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

Copy deadline for the March 1988 issue is December 1, 1987.

CO-EDITORS:
D.E. Schnell, Rt. 1, Box 145C, Pulaski, VA 24301
J.A. Mazrimas, 329 Helen Way, Livermore, CA 94550
T.L. Mellichamp, Dept. of Biology, UNCC, Charlotte, NC 28223
Leo Song, Dept. of Biology, California State University, Fullerton, CA 92634

Seed Bank: Patrick Dwyer, St. Michael's Episcopal Church, 49 Killean Park, Albany, N.Y. 12205, U.S.A.

ACTING BUSINESS MANAGER AND MANAGING EDITOR: Leo C. Song, Jr.

PUBLISHER: The International Carnivorous Plant Society by the Fullerton Arboretum, California State University, Fullerton, CA 92634. Published quarterly with one volume annually. Typesetting: California State University, Fullerton Reprographic Center. Printer: Kandid Litho, 129 Agostino Rd., San Gabriel, CA 91776. Circulation: 817 (221 new, 596 renewal). Dues: $10.00 annually. $15.00 foreign. Reprints available by volume only ©1987 Carnivorous Plant Newsletter. All rights reserved.

CPN SEED BANK SPECIES RECEIPT AND DISTRIBUTION LIMITATIONS

by Donald Schnell

Due to recent restrictions placed on open exchange of plants or plant parts interstate in the United States and internationally, it will not be practical for the CPN Seed Bank to deal with some genera. The necessary paperwork for permits would not only involve the Seed Bank and potential recipients, but also seed donors. Also, a three party exchange with the Seed Bank as intermediary may not be allowable. In either event, we ask that donors observe the following restrictions, and that potential recipients of material from the Seed Bank understand why certain genera may have been dropped from shipment to their locality.

RECEIPT RESTRICTIONS—

The Seed Bank will not accept seeds of *Sarracenia oreophila* from either domestic or international sources.

The Seed Bank will not accept seed of other Sarracenias and any Nepenthes from **international** sources.

SEED DISPERSAL RESTRICTIONS—

The Seed Bank will not distribute seed of *S. oreophila* to any domestic or international address.

The Seed Bank will distribute seed of other Sarracenias and any Nepenthes within the United States only.

Please keep this article or a copy handy for reference as you review the Seed Bank list each issue for possible purchase or donation. Also, any additional plants added by CITES or US to appendices or other conservation restrictions will be announced in the future.

ICPS Seed Bank

(as of 31 December 1987

Capsella bursa-pastoris (10) <non CP>; *Darlingtonia californica; Dionaea muscipula; Drosera aliciae (6); D. binata dichotoma* (3); *D. burkeana* (15); *D. capensis* <narrow leaf>; *D. capillaris* (1); *D. communis* (3); *D. erythrorhiza; D. filiformis filiformis* (10); *D. glanduligera; D. intermedia; D. intermedia* <Carolina Giant> (4); *D. intermedia* <maxima> (3); *D. pygmaea* (2); *D. rotundifolia; D. spathulata* (2); *D. spathulate* <Formosa> (2); *D. stolonifera stolonifera; Polypompholyx multifida; Sarracenia alata; S. flava* (2); *S. leucophylla; S. minor; S. purpurea; S. purpurea purpurea* (5); *S. rubra gulfensis* (3); *S. rubra wherryi; S.* X *areolata* X self (11); *S. flava* X *(alata* X *flava)* (10); *S.* X *chelsonii* (10): *S. purpurea* X *S. psitt.* (2); *Utricularia lateriflora* (4); *U. subulata* (10); *U. uliginosa* (8); *U. violaceae* (10).

Special Announcement

Enclosed with this issue is your renewal envelope. The Co-editors are very happy to announce that dues remain unchanged. Please renew as soon as possible so that the files can be updated for the March, 1988 issue. If you have already renewed, this envelope can be used in any communication with the Society. Thank you for your support and contributions . . . keep those articles coming.

News and Views

TOM KAHL (1351 Lake Washington Blvd. So., Seattle, Washington 98144) writes: While on my second trip to Cebu, Philippines to learn Eskrima (Philippine stick-fighting) under Bonifacio D. Uy then the National champion, B.D. Yu and I started the Nepenthes Club to control the flies produced by the fighting cocks he raised. We wanted something natural to control the pest because the pesticide laid down to kill the flies also affected the native sparrows and his chickens that ate the dead flies.

When I returned to Seattle I located ICPS and found *Nepenthes* to be native to the Philippines but rare in Cebu because of its deforestation. Unsuccessful with native Cebu mixes in seed sprouting I needed a germination medium that was universal even in poverty.

In the photo I am holding *N. khasiana* seedlings sprouted in common cotton. Two seeds have germinated. These have been fed *Nepenthes* drain water and are still growing strong. Several ungerminated seeds can be seen on the surface of the cotton.

Also I was very intrigued by Peter Tsang's use of foam produce crates in his article "CP Growing the Unique Way" CPN Vol. 9. I located some crates here in the Seattle area. These crates were used for the California Thompson Grapes. They have the depth of approx. 4" and the area of a common flat. I use these successfully for seedlings of flytraps and pitcher plants. These foam flats sit in the bed of a cold frame lined with plastic to act as a large water tray. The extra depth improves growth and keep the roots cool. Photos enclosed.

ISAMU KUSAKABE (5-14-6 Chitosedai, Setagaya, Tokyo, 157 Japan) writes: Here I enclose the color slides of CEPHALOTUS. They are aberrant form of pitchers which built up from normal leaves. It is possible that is primitive form of normal pitchers.

SAN FRANCISCO FLOWER SHOW
28-30 August 1987

***S. leucophylla* Best in Show Award**

P. D'Amato with Brisbane Award

***Cephalotus* winner of Brisbane Award. Photos by J.A. Mazrimas**

JOE MAZRIMAS, co-editor reports: Once again, the San Francisco Fair flower show celebrating its 50th year, was the setting for a large display of 68 diverse species of CP. This year we had several new participants who not only brought down some rare CP to display but also took some of the top prizes in this event. The show took place August 28-30th with large crowds of onlookers not only admiring the plants but watching the now classical "Nature" show of "Deathtrap" that shows many of the species in action. Tony Rae, once again, did a splendid job of setting up the display. New members who wish to participate are welcome. Contact me for details on how to enter the next show before July.

The exhibitors were: myself, my wife, Peter D'Amato, Charles Powell, Mike Morris, Larry Logoteta, Rick Goodwin, Mickey Urdea and Paul Bourbin. The Best in Show award went to Kathy Mazrimas for a 3 ft. tub of gigantic *Sarracenia leucophylla.* The Brisbane Award for the best Australian plant was won by Peter D'Amato for *Cephalotus.* His name will be inscribed on the faceplate of the perpetual trophy given by the society for this event.

DON SCHNELL (Rt. 1, Box 145C, Pulaski, VA 24301) reports from another letter received from Bruce MacBryde of the USFWS on 25 Aug. 1987. In addition to all Sarracenias being placed in Appendix II (other than "*S. rubra* complex" members and *S. oreophila* which are in Appendix I), *Nepenthes khasiana* has been added to Appendix I, and *N. rajah* and all other *Nepenthes spp.* have been placed in Appendix II, effective 22 Oct. 1987. As of that date, anyone wishing to engage in international trade of these species between CITES party nations must have the required permits.

Dr. MacBryde also is soliciting comments on the *Sarracenia* identification sheets which will not be placed in manuals in present format. Send any comments or suggestions to Bruce MacBryde, Ph.D., Chairman, CITES Plant Working Group, Fish and Wildlife Service, U.S. Dept. of the Interior, Washington, D.C. 20240, USA.

STEPHEN WILLIAMS (Biology Dept., Lebanon Valley College, Annville, PA 17003) sent us a front page from a tabloid (the kind you glance at in the supermarket line, but of course never buy!) which caused him to buy his first tabloid. It shall be unnamed. Next to the articles on self Cesarean sections, chimps pregnant with human babies, and the teen avenger, was one from Venezuela. A lady there supposedly grew CP in her yard, and one day the neighbors—after not seeing her for some time—found items of jewelry and clothing next to the CP bed which was also greatly disturbed. Living or dead, she was never found. the detectives supposedly concluded she suffered a stroke or fell or something, and while lying immobile on the bed of CP was totally digested except for her jewelry and clothing.

Back to detective school.

IN AN ARTICLE ON WATERLILIES . . .

From: **Missouri Botanical Garden Bulletin** Vol. 65, No. 5, July-Aug. 1986. Sent by **Dr. Bruce MacBryde,** Smithsonian Institution.

The flowers of some species of *Nymphaea,* including at least one that is ancestral to hybrids on display [at Missouri Botanical Gardens], have a carnivorous means of exchanging pollen. When the flower opens, a pool covering the stigma (the organ that receives incoming pollen) is exposed in such a way that insect visitors fall in and drown. Pollen washes onto the stigma from the victim, which is digested. On the second day, inward bending of the stamens (the organs that produce pollen) blocks the pool, allowing insect visitors to escape after a dusting with pollen to possibly perish in the pool of a different flower, thereby transferring pollen.

NOTE: This remarkable phenomenon can be clearly seen in a movie shown on NATURE on PBS called "Sexual Encounters of the Floral Kind"; about pollination syndromes. The waterlily flower is, of course, not carnivorous in the traditional sense in that it does not digest and absorb nutrition from the victim, as far as we know. By **Larry Mellichamp.**

"CORRECTIONS TO THE WORLD CARNIVOROUS PLANT LIST"

by Authur Jan Schlauer
Zwischenstr. 11, 6000 Frankfurt/Main 70
Federal Republic of Germany

Due to some confusion between the author and the CPN editorial team some misprints occurred in the world carnivorous plant list (CPN 15(3-4):63-113). Here come the necessary corrections and additions.

The author thanks all who wrote with questions and remarks, especially Mr. J. Marabini, Germany, Mr. P. Mann, Australia, Mrs. S. Determann, USA, Mr. Bill Hanna, Australia, and Mr. S. Hugentobler, Switzerland.

The list is stored on a computer and permanently updated. Those interested in the most actual version (the whole list) may obtain it in return for printing and mailing (!) costs (Europe = US - $6, Overseas (airmail) = US - $ 10) from the author.

LITERATURE CITATIONS:

Corrections:

The "Steyermark 1985" article doesn't exist. (I have sent you the correct citation with my second literature listing - it was thought as a correction of, not an addition to the "1985" citation !)

The name of the **Triphyophyllum** family is **Dioncophyllaceae,** not **Dinocophyllacea.**

The correct Taylor (1977) citation must go:

Taylor, P. (1977): *Lentibulariaceae. Fl. Malesiana, Djakarta, ser. I 8(2):275-300.*

The correct Index Londinensis citation:

Stapf. O. (1929): Index Londinensis to Ill., Kew.

Additions:

Fromm-Trinta, E. & Taylor, O. (1985): *Genlisea pallida, nov. esp. gen. Genlisea,* Bradea 4(27):176-179.

Joseph J. & Mani, J. (1983): ***Utricularia khasiana*** *nov. spec.,* Bull. Bot. Surv. India 25(1-4):192-194.

Ruiz, J. & Rzedowski, J. (1986): *Three new* **Pinguicula** *spec. of Mexico,* Phytologia 60(4):255-263.

Subramanyam, K. & Yovanarasimhan, S.N. (1981): *A new species of* **Utricularia** *from Bangalore distr., Karnataka,* J. Ind. Bot. Soc. 60:123-127.

LIST CORRECTIONS:

Darlingtonia TORR.

D. californica *TORR.* CALIF., OREGON USA

Heliamphora BENTH.

H. heterodoxa *STEYERM.* var. glabra *MAGUIRE* = heterodoxa *STEYERM.* f. glabra *(MAGUIRE) STEYERM.*

H. neblinae *MAGUIRE* var. viridis *MAGUIRE* = tatei *GLEASON* var. neblinae *MAGUIRE) STEYERM.*

H. tatei *GLEASON* var. macdonaldae *(GLEASON) MAGUIRE* = tatei *GLEASON* f. macdonaldae *(GLEASON) STEYERM.*

SARRACENIA L.

S. adunca *SM.* = minor *WALT.*
S. X catesbaei *ELLIOTT* = flava *L.* X purpurea *L.* VA., NC., SC., GA., FLA., ALA. USA
S. flava *L.* var. rugelii *SHUTTLEW. & MAST.* = flava *L.*
S. X georgiana *HORT. BONST.* = (purpurea *L.* X (purpurea *L.* X rubra *WALT.*) X (minor *WALT.* X purpurea *L.*)
S. gronovii *WOOD* var. rubra *WOOD* = rubra *WALT.*
S. X illustrata *HORT. EX NICHOLS.* = flava *L.* × (flava *L.* X purpurea *L.*)
S. jonesii *WHERRY* = rubra *WALT.* ssp. jonesii *(WHERRY) WHERRY*/rubra *WALT.* ssp. wherryi *(CASE & CASE) SCHNELL*
S. X kaufmanniana *HORT. BONST.* = (purpurea *L.* X rubra *WALT.)* X purpurea *L.*
S. X laschkei *HORT. HEFKA* = (purpurea *L.* X psittacina *MICHX.)* × (flava *L.* X leucophylla *RAF.)*
S. X mandaiana *HORT. PITCHER & MANDA EX MAST.* = leucophylla *RAF.* X flava *L.*
S. X 'Marston Mill' *HORT.* = (leucophylla *RAF.* X (flava *L.* X purpurea *L.*) X flava *L.*
S. X melanorhoda *HORT. VEICH EX NICHOLS.* = (purpurea *L.* X flava *L.*) X purpurea *L.*
S. X sanderae *NICHOLS.* = leucophylla *RAF* X (flava *L.* X minor *WALT.)* X purpurea *L.*) ?
S. X sanderiana *HORT. SANDERS EX NICHOLS.* = leucophylla *RAF.* X (leucophylla *RAF.* X rubra *WALT.)*
S. X stevensii *HORT. EX MAST.* = flava *L.* X purpurea *L. (STEVENS)*
S. X swaniana *HORT. EX NICHOLS.* = minor *WALT.* X purpurea *L.* NC., SC., GA., FLA. USA
S. X umlaufiana *HORT. HEFKA* = (purpurea *L.* X psittacina *MICHX.)* X (leucophylla *RAF.* X psittacina *MICHX.)*
S. X vetteriana *HORT. HEFKA* = (flava *L.* X (purpurea *L.* X flava *L.*) X (flava *L.* X purpurea *L.*)
S. X vittata (maculata) *HORT. EX NICHOLS.* = purpurea *L.* X (purpurea *L.* X rubra *WALT.)*
S. X vogeliana *HORT. HEFKA* = (purpurea *L.* X psittacina *MICHX.)* X (flava *L.* X purpurea *L.*)
S. X willisii *HORT. VEITCH EX NICHOLS.* = (purpurea *L.* X psittacina *MICHX.)* X (purpurea *L.* X flava *L.*) X purpurea *L.*)
S. X willmottae *HORT. BRUCE* = (flava *L.* X purpurea *L.*) X purpurea *L.*

Cephalotus LABILL.

C. follicularis *LABILL.* W AU

Drosera L.

D. compacta *EXCELL & LAUNDON* = bequaertii *TATON*
D. dielsiana EXCELL & LAUNDON S AF
D. X henryana *HORT.* nom. nud. = capensis *L.* X aliciae *HAMET*
D. X hybrida MACF. = filiformis *RAF.* X intermedia *HAYNE* NJ. USA
D. incisa *A. RICH.* = Utricularia incisa *(A. RICH.) ALAIN*
D. kaieteurensis BRUMM.-DING. GUY.
D. X 'linthulata' *KUSAKABE* = linearis *GOLDIE* X spatulata *LABILL.*
D. triflora *COL.* = spatulata *LABILL.*

Nepenthes L.

N. X behnickii *HORT. BONST.* = (northiana *HOOK. F.* X maxima *REINW.)* X maxima *REINW.)* X (northiana *HOOK. F.* X maxima *REINW.)* X maxima *REINW.)*

N. macfarlanei *HEMSL.* MALAYSIA

N. X 'Mino'o' *HORT.* = ventricosa *BLANCO* X (sanguinea *LINDL.* X Khasiana *HOOK. F.)*

N. mossis *DANSER* BORNEO

N. X 'Nagoya' *HORT. KONDO* variegata *HORT.* = (northiana *HOOK. F.* X maxima *REINW.)* X thorelii *LECOMTE (TOYOSHIMA)*

N. nephelophyllum *HORT.* = ?

N. X neufvilliana *HORT. BONST.* = (northiana *HOOK. F.* X maxima *REINW.)* X maxima *REINW.*/mirabilis *DRUCE* X (gracilis *KORTH.* X khasiana *HOOK. F.)*

N. pitcheri *HORT. EX MILLER* = (mirabilis *DRUCE* X (trafflesiana *JACK* X ampullaria *JACK)* X (gracilis *KORTH.* X khasiana *HOOK. F.)* X (rafflesiana *JACK* X ampullaria *JACK) (PITCHER & MANDA)*

N. rafflesiana *JACK* var. glaberrima *HOOK. F.* = rafflesiana *JACK*

N. tobaica *DANSER* SUMATRA = reinwardtiana *MIQ.?*

N. tomentella *MIQ.* = albomarginata *LOBB EX LINDL.*

N. X 'Tsujimoto' *HORT.* = (sanguinea *LINDL.* X khasiana *HOOK. F.)* X (mirabilis *DRUCE* X (rafflesiana *JACK* X ampullaria *JACK) (TAKARAZUKA)*

N. veitchii *HOOK. F.* BORNEO = maxima *REINW.?*

Genlisea ST. HIL.

G. pallida *FROMM-TRINTA & P. TAYLOR ZAM.*

G. uncinata *P. TAYLOR & FROMM-TRINTA BRA.*

Pinguicula L.

P. barbata *RUIZ & RZEDOWSKI* MEX.

P. emarginata *RUIZ & RZEDOWSKI* MEX.

P. X 'mola' *WEINER* nom. nud. = moranensis *H.B.K.* X gypsicola *BRANDEG.*

P.ramosa *MIYOSHI EX YATABE* JAPAN

P. ramosa *MIYOSHI EX YATABE* f. albiflora *KOMIYA & SHIBATA* = ramosa *MIYOSHI EX YATABE*

P. X sethos *WEINER* nom. nud. = ehlersae *SPETA & FUCHS* × moranensis *H.B.K.*

P. takakii *RUIZ & RZEDOWSKI* MEX.

P. vulgaris L. f. albida *(BEHM) NEUMANN* N BOREAL

Utricularia L.

U. acicularis *SOLAND. EX STAPF* = bisquamata *SCHRANK*

U. benthamii *P. TAYLOR* W AU

U. cheiranthos *P. TAYLOR* N. AU

U. circumvoluta *P. TAYLOR* N AU

U. corynephora *P. TAYLOR* BURMA, THAIL.

U. delicata *KAM.* = bisquamata *SCHRANK*

U. determannii *P. TAYLOR* SUR.

U. garrettii *P. TAYLOR* THAIL.

U. khasiana *JOSEPH & MANI* INDIA

U. nivea *VAHL* var. caerulea *VOIGT* = caerulea *L.*

U. perminuta *F. MUELL.* = violacea *R.BR.*

U. rehmannii *KAM.* = bisquamata *SCHRANK*

U. reticulata *SENSU VOIGT* = polygaloides *EDGEW.*

See corrections on page 103

Nepenthes Corrections to WORLD CARNIVOROUS PLANT LIST CPN 15(3-4)

by I. Kusakabe
5-14-6 Chitosedai
SetaGayo, Tokyo
157 Japan

N. Accentual Koto Hort. ex Kawase = thorelii X hookeriana (1974)
N. Ambrosial Koto Hort. ex Kawase = trichocarpa X hookeriana (1974)
N. Balmy Koto Hort. ex Kawase = thorelii X maxima (1975)
N. Effulgent Koto Hort. ex Kawase = mirabilis X thorelii (1978)
N. Hachijo Okuyama = lecouflei X mirabilis (1979)
N. Ille de France, Y. Vezier (France) = lecouflei X mixta (1981)
N. Ville de Rouen, Y. Vezier (France) = Superba X Mastersiana (1981)

Evolution in Lentibulariaceae: A Criticism of Snyder

Martin Cheek, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB

We are told by Ivan Snyder in a recent number of this journal (C.P.N.*16*(1):17-19) that 'Carnivorous plant evolution has been a mystery for a long time.' His account, which purports to 'hypothesize the most logical evolutionary scheme' for the Lentibulariaceae, does little to clarify the mystery; worse, it is grossly misleading, is at variance with the facts and will only serve to confuse a great many people.

His suggestion that *Pinguicula* is the most 'primitive' genus of the family is a widely held one. But the steps he suggests for the evolution of *Pinguicula* into *Utricularia* (briefly summarized as follows) are incredible:

Firstly, we are told, air floats develop in the roots of the butterwort. These were 'very advantageous and kept the plant buoyant when washed into water, where it could grow on the surface where there was less competition.'

Secondly, glandular hairs and enzyme glands were relocated from the leaves to the inner surface of these root float bladders, animals finding their way into them and becoming digested.

Thirdly, 'this new trapping device developed a good passageway into itself and proved to be very efficient.' The butterwort leaves become a burden and are reduced, lose their glue. Some of these become *Genlisea,* others evolve onwards to become *Utricularia:* their traps form oneway doors.

Fourthly, 'the bladders (gain) the ability to alter turgor pressure in some of its cells when touched. Cellular turgor is controlled in the plants phototrophic response to make possible the ability to turn toward light. When this became relocated to the walls of the bladders, the bladders could warp and produce a vacuum in the trap.'

Presto! We have *Utricularia!* Or do we?

Amongst the 'facts' upon which 'the most logical evolutionary scheme' is supported are that 'aquatic' bladderworts use their bladders not only for trapping, but also in flotation. This idea is patently not true and was disproved in the last century (Darwin, 1875). Its veracity is simply tested by cutting the traps off a plant: the plant still floats! The basis of this false flotation function of traps seems to be Snyder's view that they are full of air, since

they are supposedly developed from airspace derived root-floats. In fact, *Utricularia* bladders only operate when full, or very nearly full, of water. Air occurs largely as an artefact, introduced when plants are taken out of their aquatic environment (Lloyd, 1942).

Further, we are confronted with the root float origins of the *Utricularia* trap. Surely, everyone knows that *Utricularia,* like *Aldrovanda,* has *no* roots! Even the most basic textbooks of botany (Metcalfe and Chalk, 1961) admit that from the seed onwards, no root is ever differentiated in *Utricularia.* This is the most fundamental of errors conceivable in homology. Whether or not a *Pinguicula* ever developed root floats (it seems most unlikely that they were so 'very advantageous', for if they were, surely some of the present day ones would possess them!) and supposing for a moment that in some ancient *Pinguicula* these root floats did develop into animal traps, it is certain that such were *not* the ancestors of *Utricularia* where the traps are stem-leaf derived.

Next, we must deal with Snyder's monumental fallacy concerning the operation of the *Utricularia* trap. Leaving aside his antedeluvian beliefs in air-filled, floating, root-derived traps, we must now face his view that "Mutations ... gave the bladders the ability to alter turgor pressure in some of its cells when touched. Cellular turgor is controlled in the plants phototrophic response to make possible the ability to bend toward the light. When this became relocated to the walls of the bladders, the bladders could warp and produce a vacuum [negative pressure] in the trap." This is simply not true (cf. Fineran, 1985; Lloyd, 1942). The negative pressure in the trap is caused by the internal glands pumping water to the outside, *not* by the walls warping. The walls do indeed warp, but this is effect, rather than cause. The negative pressure developed in the trap, responsible for the ability to 'suck animals through the door' has nothing to do with phototrophic responses in the form of turgor pressure in the bladder walls.

If, indeed *Pinguicula* is the ancestor of *Utricularia,* it is far more likely that the traps are evolved from the leaves. True, it is still extremely difficult to imagine, let alone reconstruct, how this, the most sophisticated animal trapping device in the plant world (Lloyd, 1942), evolved, or why it has developed in such bewildering diversity (see Taylor, 1964). No need the to invoke relocation of leaf hairs and glands to the roots, or the fantastical fairy tale of air-filled root bladders and floating Butterworts.

Ivan Snyder is to be commended on his well written article. But one should be aware that it is largely science fiction, not fact.

References:

Darwin (1875), *Insectivorous Plants:* 404 London.

Fineran (1985), Isr. J. Bot. *34*:295

Lloyd (1942), *The Carnivorous Plants* Chronica Botanica

Metcalfe and Chalk (1950), *Anatomy of the dicotyledons 2*:993

Snyder (1987), C.P.N. *16*(1):17-19

Taylor (1964), Kew Bulletin *18*(1):1-245

Corrections continued from page 101

U. roseopurpurea *STAPF EX GAMBLE* = caerulea *L.*
U. sampathii SUBRAMANYAM & YOGANARASIMHAN INDIA = caerulea *L.* ?
U. schinzii *KAM.* = bisquamata *SCHRANK*
U. welwitschii *OLIV.* var. odontosepala *(STAPF) P. TAYLOR* = odontosepala *STAPF*

Pale-flowered varieties of *Pinguicula grandiflora*

by Jurg F. Steiger, Berne (Switzerland)

Referring to E.C. Nelson's paper "CP in Ireland," CPN 15 (2): 41-47, I can add the following information concerning pale-flowered forms of *P. grandiflora:* On May 29, 1956, Prof. D.A. Webb (University of Dublin School of Botany) sent me a normal and an almost white specimen of *P. grandiflora* from the Burrens near Ballyvaghan in Clare County. He wrote to me: "There is also a variety (of *P. grandiflora)* that I have never seen elsewhere, with very pale, almost white flowers." The interesting tendency to form pale-flowered varieties is also observed in other *Pinguicula* species and is not restricted to Ireland.

In *continental* Europe *P. grandiflora* exists in one dark and *two pale* forms:

In the Jura valleys, north of Geneva, near the French- Swiss border (e.g. between the Col de la Faucille and Mijoux) the pale-blue *forma pallida* (Gaudin) Casper is quite abundant. At some habitats it grows in dozens of specimen, but always associated with the prevailing normal dark-flowered form. The *f. pallida* is never totally white but very pale blue with a dark blue spot at the basis of the central lower corolla lobe. Even at sunny places neither calyx, seed capsule and stem nor the hibernaculum (winter bud) displays any reddish or purple pigment (in the dark-flowered form they do). Phenotypical intermediates between the pale and the dark form are not found.

The mountains near Grenoble are the habitats of the pink-flowered *ssp. rosea* (Mutel) Casper. Neither the normal dark-flowered *P. grandiflora* nor the *f. pallida* are present there. The *ssp. rosea* is geographically and genetically isolated. It differs from the *f. pallida* by somewhat smaller blossoms, a shorter and slimmer purple spur, the purple calyx and the pink-white colour of the blossom with reddish stripes in the corolla throat but lacking the darker spot at the basis of the lower lip. Calyx, seed capsule and stem are purple, the winter buds often show a slightly reddish pigmentation.

The chromosome numbers of *P. grandiflora* and all its varieties are identical (2n + 32). Pursuant to the Hagerup-Tischler evolution rule *P. grandiflora* is therefore an older species than *P. vulgaris* (2n + 64)

Coming in 1988

* A New *Drosera* from the Section Arachnopus?
* On the Care and (Not) Feeding of *D. adelae, prolifera* and *schizandra.*
* Changes in Regulations Effecting International Trade in CP.
* CITES, TRAFFIC, USFW - Are You Caught in the Alphabet Soup?
* Propagation and Culture of Western North American CP.

Color types of *P. grandiflora*

The three color types of *grandiflora* in continental Europe: The dark-flowered *P. grandiflora*, the *forma pallida* (middle) and the *ssp. rosea*.

***P. kondoi*. Photo by Richard Tilbrooke of South Australia**

MEXICAN PINGS

Charles L. Powell, II
2138 Harrison Street, Santa Clara, CA 95050

Introduction

Mexico contains about 25% of the world's *Pinguicula* species (19 out of 51 species on the CPN World CP list, 1986), including many of the most beautiful species. The group known as the orchid-flowering butterworts is probably the best known of the Mexican pings. But, there are several other groups and some interesting species from these groups will be discussed here. The orchid-flowering butterworts, especially, and most other Mexican pings are difficult to disinguish from one another because they are vegetatively very similar, and the leaves show commonly distinctly different forms that vary with the season. In the summer growing season the plants have long, fleshy leaves, while during the winter months the plants form tight rosettes of small, thin leaves.

Mexican pings commonly grow at high altitudes, generally between 1500 and 3000m, and are found in calcareous or alkaline soils associated with pine and oak forests. Growing conditions range from nearly total shade to full sun, on banks, cliffs and even epiphytically. Because of these cooler growing conditions Mexican *Pinguicula* can be easily grown in the temperate regions of the world. As a result, they are fairly well suited to the temperature range found in a house, although they generally need considerably more humidity than is found in most homes.

Cultivation

I have grown these plants for a number of years now and find them easy to cultivate and flower. These plants can be easily cultivated indoors in an aquarium, outdoors in a protected environment in mild climates, or in a greenhouse where the climate can be controlled.

Soil medium.—I have used many soil mediums in the past, but the one I favor at present is a 2:1:1 mixture of peat, sand, and perlite, filled to about 2 to 3cm below the rim of the pot. The remainder of the pot is filled with live, or dead, coarse sphagnum moss, and the plant is inserted into the sphagnum moss. Favorable results can also be obtained using the peat, perlite, sand mix discussed above, using straight sphagnum moss, or just a peat sand mix. I suggest you experiment and see what works best in your growing conditions. Gypsum and lime are also commonly added to the soil but I have found their use unnecessary for good results.

Water levels.—Always use pure, distilled or rain water. During the summer the plants can sit in a tray which is always filled with water. While during the winter I wait for the spagnum moss that the plants are growing in starts to look dry before I water, and then I water minimally so the water isn't sitting around for weeks which could cause fungus or rot.

Light.—Medium light, under benches is generally too dark. Indoors they can be grown under fluorescent light at a distance of between 6 to 12 inches. The more light the more color will develop on the leaves.

Temperature.—I try to keep my plants above 45° F, although they have experienced temperatures near freezing with no ill effects. Summer temperatures in excess of 100° F have been experienced for short periods by the plants with no ill effects either. But, the ideal temperature range for these plants is between 50° and 80° F, with cool nights.

Humidity.—Ideally between 40% and 80%.

Dormancy.—Some of the Mexican species experience a winter rest state, which is easily recognized by the short, thick leaves that form in a tight rosette during the winter months. *Pinguicula gypsicola* is a particularly excellent example.

Containers.—Generally the larger the better, and they do not need to be deep. A single plant of most of the taxa below can be grown in a 4-inch pot, but some like *P. moranensis,* will quickly outgrow the smaller container and should, for best display, be grown in an 8-inch pot. I generally grow several plants of the same species together in large shallow pots. For species like *P. ehlersia* and *P. esseriana* a 6-inch pot is ideal and can handle 4 or 5 plants. For plants like *P. moranensis* and *P. agnata,* I commonly grow a single plant in an 8-inch pot, or with two or more specimens in a 10- or 12-inch pot.

Propagation methods

These plants can easily be grown from seed. The fresher the seed the better. I grow seedlings in a peat, sand mix and they do well.

The best way to propagate these plants is by leaf cuttings, which are best taken in winter but can be collected any time. An entire leaf is detached from the plant near its point of attachment, and then one of three things can be done with it: 1.) The leaf can be pulled out a short way from beneath the remaining leaves, but still partially covered by its leaves. New plants will develop at the point of attachment with the plant and after a few weeks (2 to 4 generally). Then the leaf can be pulled the remainder of the way out from beneath the plant and either left associated with the larger plant or transferred to an individual pot; 2.) The leaf can be detached and laid on the surface of the growing medium with the tip that was attached to the parent plant partially buried in the soil. Sometimes these will dry out, but generally they will form new plantlets at the tip. This method is slightly less successful than that of number one; or 3.) In a method shown to me by Steve Smith, the leaf can be detached, put into a zip lock bag and left in a dark drawer for 3 to 6 weeks, where about 50% of the leaves will form plantlets. This last method produces larger plantlets because of the lack of light. Last winter I was able to develop plantlets on every leaf of *P. oblongiloba* with which I used this method, but had no success with *P. agnata.*

Species descriptions

All the taxon here are easy to grow and should provide hours of satisfaction to the grower. Man-made hybrids are now starting to appear among the *Pinguicula* and a couple hybrids are discussed and illustrated here.

Pinguicula agnata.—This species is easy to grow, has large, thick, elongate leaves and does not form a winter bud. The flowers are moderately large, white with light blue around the throat and at the end of the petals. It is also characterized by a short spur (fig. 1).

P. ehlersae.—Forms a tighty rosette of long, thick, narrow leaves which do not differ from Winter to summer. The flower is light lavender with a moderately-short spur and the flower generally appears to bend in the middle (fig. 2).

P. esseriana.—This plant is very similar to *P. ehlersae,* being indistinguishable when not in flower. Its flower is similar to a small version of *P. moranensis,* but with a beautiful light purple hue that almost seems to shine (fig. 3).

P. gypsicola.— This distinctive plant is easily recognized by its long, narrow, pointed leaves. The flower is purple and very similar to *P. moranensis,* but differs in having narrower petals which are thinner and more rounded than in *P. moranensis* (fig. 4). This species and *P. moranensis* are a couple of the orchid-flowering butterworts, *P.* sp. 'Guatamala' may also belong to this group.

P. moranensis.—Plants of *P. moranensis* can grow quite large (to 24cm diameter) and are quite variable both vegetatively and floristically. The leaves of this taxon are large, broad, and thin. The plant does not generally form a distinct winter resting bud, but growth slows and some forms develop shorter leaves. This flower is large, up to 5cm from top to bottom, with a long spur. The color is quite variable: from purple (fig. 5) to lavender, red, and even a white clone is now being cultivated.

Figure 1.—Flower of *P. agnata*.

Figure 2.—Flower of *P. ahlersae*.
ALL PHOTOS BY AUTHOR

Figure 3.—Flower of *P. esseriana*.

Figure 4.—Flower of *P. gypsicola*.

Figure 5.—Flower of *P. moranensis*, J. Mazrimas collection.

Figure 6.—Flower of *P. sp.* 'Guatamala.'

Figure 7.—Flower of *P.* x *"mola."*

Figure 8.—Flower of *P.* x *"weser."*

P. sp. 'Guatamala'.—This unidentified species collected in Guatamala by Aric Bendorf is being introduced into cultivation by Leo Song, CSUF. The plant looks very similar in its vegetative parts to a small *P. moranensis,* but forms a distinct winter resting rosette, and the flower is distinctly different. The flower is a light purple color and is generally similar to *P. moranensis,* but can be distinguished by the lower petal being much longer than the other petals, by the spur which is long, but which curves upward, and finally by the top two petals, which commonly recurve back over the stem (fig. 6). Although rare at present, this taxon is easy to propagate and should become generally available in the near future.

P. "mola" (P. moranensis x *P. gypsicola).*—This plant forms a tight rosette of leaves during the winter, which expand to about 12cm during the summer. The summer leaves are indistinguishable from a small *P. moranensis.* The flower of this hybrid is very beautiful. It is pink, with a well marked throat and the bottom petal has a slight undulate margin (fig. 7).

P. "weser" (P. moranensis x *P. ehlersae).*—Because the name of this and the proceeding plant have not been officially recognized, they are considered *nomina nuda* (naked names) and so are included here in quotes. This plant is easiest to grow of any of the above and flowers freely during most of the year. The plant is similar to *P. moranensis,* but doesn't grow larger than about 12cm diameter. Without the flower it is almost indistinguishable from *P. "mola",* but it flowers freely making it easily recognizable. The flower is smaller than *P. moranensis,* seldom exceeding 5cm maximum diameter and is purple with a small white throat swatch (fig. 8).

I would like to thank Mary McGann, U.S.G.S. and Leo Song, C.S.U.F. for reviewing the article and adding their helpful criticism. I would also like to hear from other people about their experiences growing these plants.

Cultivating Utricularia Reniformis

By Curtis Yax
233 Chestnut St.
Oneonta, N.Y. 13820

The cultivation of *U. reniformis* is very worthwhile for this striking epiphyte has both elegant leaves as well as stunning flowers. The plant grows mainly upon trees laden with moss in tropical Brazil but also can be found growing terrestrially in swamps. Their long, branching stolons intertwine with the moss and bark, securely fastening the bladderwort to the trunk and branches. The large, reniform leaves are situated on top of ascending 12 inch stems and it is these elegant leaves that gave the plant its Latin name. The flowers are said to be large and orchid-like, but my plants never produced them, possible because they were disturbed several times for divisions or the exact amount of light has not reached them. Some orchid species have exact light requirements to produce their blooms.

Since this species is such a large plant, one would expect gigantic traps but unfortunately this is not the case. The traps are small but liberally produced and nourishment comes from the trapping and digestion of minute crawling creatures.

There are two varieties in cultivation; a large, robust form and a smaller one. I grow the larger form which does very well in live Sphagnum moss placed in a large glass bowl. The 5-inch bowl is placed in a 55 gallon terrarium which also houses my *Nepenthes, Drosera, Pinguicula* and other *Utricularia* species. The bowl is placed next to the side of the tank for easy viewing of the traps and stolons.

When it looks like the *U. reniformis* is about to escape the bowl into the terrarium, I take divisions. I carefully lift the whole plant out of the bowl, remove most of the moss and place it on the work table. I keep a plant sprayer handy filled with rainwater and frequently spray the plant so that it does not dry out. With a clean, sharp razor blade, I cut off large sections that have at least one leaf showing with a few stolons spreading outwards. These stolons are white and thick, so it is best to cut into narrowing branches which connect the rhizoid-like section. Place each new plant in a plastic cup filled with moist, live sphagnum moss. Keep them shaded and undisturbed until they can be sent out as trading material.

After receiving a *U. reniformis* plant in the mail, keep the plant barely wet for several months to prevent rotting. When it's established, use rainwater to keep the moss wet but never let water accumulate on the bottom. If overwatered, the beautiful leaves will no longer be produced but instead, ugly, deformed foliage will appear. If this should happen, lay your hand on the moss and turn the container upside down so that all excess water drains out. In a while, the wonderful reniform leaves will return.

In the rainforest, these plants receive a limited amount of water in the trees, so the normal conditon for proper growth is a well-drained but wet environment. Since these rainforests are dimly lit near the ground, I feel God created their large leaves for the purpose of collecting the scarce sunlight passing through the dense canopy. By making the leaves bigger, there is more of a surface area for light to shine on the plant which benefits the process of photosynthesis. This *Utricularia* prospers well under lights switched on for 16 hours a day throughout the year. To produce flowers, the plant may have more rigid requirements. I use a 48-inch workbench reflector about 16 inches from the top of the bowl using one Grow-lux and one cool-white bulb. This combination of bulbs gives a full spectrum for healthy, vigorous growth. A temperature between 65°-80° F is maintained during winter with rising summer temperatures between 70°-100° F.

Humidity is fairly high in the terrarium, high enough for luxurious *Nepenthes* growth, but there is adequate ventilation so the glass is not all fogged up. It is good to use live sphagnum moss entirely, but dead moss topped with live growing sphagnum moss is satisfactory. I've never had any problems with fungus or pests and I use no fungicides or pesticides.

Sometime in the future, I would like to mount a specimen onto a bark slab or thick branch. This would be an attractive way to cultivate this species as it grows in its natural setting.

Suggested Reading

1) The Carnivorous Plants — Francis E. Lloyd
2) Carnivorous Plants — Adrian Slack

Special Announcement

RON GAGLIARDO (Hungry Plants, 1216 Cooper Dr., Raleigh, NC 27607) reports that his CP business is now on indefinite hold rather than a definite reopening date in January. He asks that no orders or requests for lists and catalogs be sent to him until further notice.

The Floating Isle of Carnivorous Plants

***"Sarracenia purpurea* ssp. *purpurea*. The most notable and one of the most abundant plants on the island. Note the red veins and copper hues. Though its mid-June, a flower stem is coming up."**

"Small *Drosera rotundifolia* hiding among the moss and cranberries. Note the deep reds that have developed due to the amount of sunlight it has received."

The Floating Isle of Carnivorous Plants

by Jeffrey K. Risner
615 Carriage Hill Dr., Athens, Ohio 45701

The State of Ohio is not usually thought of in terms of its native carnivorous plants. Unlike the southern states which are noted for many types of pitcher plants, sundews and others only a few are found in Ohio and these few are difficult to find in the wild. There is one site that is an exception and this is Cranberry Island near the north shore of Buckeye Lake, Ohio. Here are found *Sarracenia purpurea ssp. purpurea, Drosera rotundifolia* and *Utricularia vulgaris.* More Sarracenia are found at this location then probably exist in the rest of the state of Ohio.

Cranberry Island is located in Licking County Ohio about 30 miles east of Columbus and is just off of State Route 79 south in the community of Buckeye Lake.

Cranberry Island is, in fact, the only bog in the world that is entirely surrounded by water. The island literally floats on the lake! As the lakes water levels rise and fall, the island also will rise and fall. When the lake freezes in the winter the ice pressure will cause the island to arch in the middle. Only some 20 acres at most, the island is about 100 yards wide and 600 yards long. The outer margin of the island is ringed by trees, including Maples and Oaks, since the pH levels are alkaline. Beyond this lake water pH effect of 7 to 8, natural bog acidic conditions dominate, pH 4 to 5. About 90% of the island is open bog.

"A view of Cranberry Island from the north shore of Buckeye Lake, Ohio. Note the line of Oaks and Maples along the Island's margin. These trees cannot grow inland due to acidic conditions of the bog."

The history of this island is almost as fascinating as the carnivorous plants that grow on it. The last ice age, the Wisconsian, plowed its way across Ohio 20,000 years ago. As it advanced slowly across the state it not only changed the physical characteristics of the land but also the plant life as well. Plants that are normally found in Canada today also advanced in front of the ice sheet. These plants colonized the land until the glacier rode over two of them. In the case of the Buckeye Lake region a large pre-glacial river valley already existed. The glacier deepened and then later dropped its load of dirt and rock in the form of an end moraine on the south and the retreating ice sheet on the north. As the glacier slowly declined it retreated back toward Canada and with it the Canadian plant life. This plant life colonized the Buckeye Lake valley and formed a large lake with a sphagnum moss bog in the middle. The deep valley and thick, water soaked sphagnum preserved the Canadian bog environment for 11,000 years.

In 1830, the State of Ohio was busy building a vast canal system that went from the Erie Canal in the north to the Ohio River in the south. To make a connection with different river systems a series of locks and dams were constructed. Water was needed to flood the locks so the Buckeye Lake valley was impounded to provide a reservoir of water. This flooding destroyed most of the bog and its plants (about 4300 acres); however, a large mat of sphagnum rose up out of the water to form Cranberry Island, so named because of the cranberries. This floating island of moss was some 50 acres at that time; today it is about 15 acres.

The author spent some time on the island during the Ohio Department of Natural Resources annual Cranberry Island open house this past June 20, 1987. The numbers of pitcher plants with their flower stems in the air was, at first, overwhelming. I have never seen so many *Sarracenia purpurea* in one place and never in the wild. A 1983 estimate of the *Sarracenia* population by K.E. Schwaegerle was 157,000 plants. What is amazing is that all the pitcher plants are reportedly the descendants of a single pitcher plant that was introduced on to the island about the year 1912 by Freda Detmers. No pitcher plants were reported in any of her studies and surveys of the island before then.

The thousands that I saw were in excellent condition. Most receive full sun, except around the margins of the island where some trees have rooted and now provide shade. Wherever it was clear the pitcher plants were growing. Also, I saw little disease, mildew or decay among the pitchers. The sizes varied but on average the clumps of pitchers were 10 to 12 inches across, the pitchers were 4 to 6 inches in length with flower stems over a foot in the air. Most of the petals were gone at this time since they usually flower in late May but judging from the number of bees humming about I would say a bumper crop of seed is on the way. The contents of the pitchers were mosquitoes, ants and other insect odds and ends and the plants seemed very well fed indeed. Most of the pitchers had deep reddish veins of color running through them except for those in the shade of trees and shrubs. Here, the pitchers were green with very little red color.

The small *Drosera rotundifolia*, unlike the pitcher plant, has always been in the valley but its presence is harder to detect. Its color and size make it blend exactly with the sphagnum background. Most of the ones I saw were no more than an inch or two in diameter but very dark red and covered with gnats. The little sundews seem to like the areas next to the boardwalk of the island. Here the moss is disrupted the most and other plant competition less which make growth for the sundew ideal. Several sundews were displayed in pots for the visitors and they appeared more prominent in the natural background of the moss and pitcher plants. It was worth the effort.

The author did not see *Utricularia vulgaris*, but I was assured that it is growing in the swampy areas of the bog mat. *Utricularia minor* has been reported but has not been seen recently.

An interesting aspect of the field trip was that the air temperature at 11:00 a.m. was 85 degrees F but a thermometer on the bog surface read over 90 degrees and another only 6 inches under the surface showed only 63 degrees. The sphagnum moss makes an excellent heat insulator. The roots of many of the plants including Sarracenia are protected from extremes of temperature and kept cool year around. The water trapped in the moss absorbs heat during the summer and then releases it during the winter. This insulator/latent heat effect helps explain how northern plants can survive so far south. The sphagnum itself, is saturated with water, alive and healthy.

The carnivorous plants are not found on the shores of the lake since conditions for survival do not exist there. Only on the island can they survive and the survival of the island is in doubt. Wave action and the alkaline water of the lake are destroying it. It may last another 150 years, but who really knows? To help preserve it the island is now a Registered Landmark and Nature Preserve. Today, all that can be done is to preserve the island as well as possible. The island can be visited during the annual open house or a permit can be obtained from the O.D.N.R., Division of Natural Areas and Preserves, Fountain Square, Bldg. F, Columbus, Ohio 43224.

See it while it's still with us, this floating isle of carnivorous plants.

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THE MYSTERY OF THE NEPENTHES OR JUST HOW DID THEY GET THERE?

by Jeffrey K. Risner, 617 Carriage Hill Dr., Athens, Ohio 45701

Species of the genus Nepenthaceae are among the most beautiful of the carnivorous plants. The multi-colored and multi-shaped pitchers are truly wonders to behold. Along with the beauty of *Nepenthes* comes a mystery. How did these plants get where they are today or what method of distribution accounts for their present locations?

Nepenthes are found on the island of Madagascar, the Seychelles Islands, Sri Lanka, the Assam region of India, Thailand, Laos, Cambodia, Vietnam, Malaysia, New Guinea, the Philippines, the northern tip of Australia and the island of New Caledonia. The distance from the western limit, Madagascar, to the eastern limit, New Caledonia, is about 12,000 miles with vast areas of water in between. How could they travel so far? New Guinea and New Caledonia both support the same *Nepenthes* species, *N. vieillardii,* yet are 1200 miles apart with only a few islands and ocean between them. No *Nepenthes* are found between these two islands. Why? Madagascar is only 200 miles from Africa yet no *Nepenthes* have ever been found in Africa. Why? The Seychelles are surrounded by the Indian Ocean and *N. distillatoria* lives on its highlands; with *Nepenthes* to the east, Assam, and west, Thailand and in Malaysia, Burma has none. Again, why is this so?

Mysteries of nature are bound together by seemingly unrelated events or processes that are themselves mysteries. The mystery of the *Nepenthes* is a classic example. In the past twenty-five years earth science has undergone a revolution in theory and thought about the

structure of the earth and the forces that act on it. These forces of change effect not only the rocks and oceans of the earth but also every living thing that ever was or that ever will be. The major force or cause of change is embodied in the concept of continental drift. This concept presents the continents as mobile "plants" afloat on top of a pool of molten plastic like rock called the upper mantle. The continents are not fixed on the earth's globe but rather move upon it and in so doing collide with one another forming larger super-continents, or split apart forming oceans. Some parts of continents will split off, drift awhile and collide with another.

This grand concept, also known as plate tectonics and continental drift, which explains so much about the earth, can also be used to explain the mystery of *Nepenthes'* distribution. As with any explanation, this concept's strength will lay in its ability to solve what seem to be unrelated facts. I believe that plate tectonics explains this phenomena.

As with most things under the sun this theory is not new. Using the pioneering work of Alfred Wegener in 1928, D.H. Danser first proposed that *Nepenthes* rode the continents. Wegener was probably the first to suggest the concept of continental drift and published his theories in 1924. Wegener believed that India was connected to Africa and Asia and split from Africa about 180 million years ago. Danser, therefore, believed that *Nepenthes* evolved in Asia on the Indian sub-continent and spread from there. In 1930 Du Toit revised Wegener's work by placing India with Africa so that India split from Africa and collided with Asia, thus forming the Himalaya Mountains 40 million years ago. Today's concepts, (with some modifications), follow the Du Toit revision.

It's time to give a quick review of what is now believed to have happened to the earth since the last super-continent, called Gondwanaland, broke up. Below is a chart of events and the approximate times involved. Time is expressed as MYA or Million Years Ago.

TIME	EVENT
140-160	Initial separation of South America and Africa from Madagascar, Antarctica, India and Australia
140	Madagascar, Seychelles Islands and India separate from Antarctica and Australia
120-135	Flowering plants, the Angiosperms, evolve. *Nepenthes* soon follow
100	India and Seychelles separate from Madagascar
80	East Australia Rise with New Caledonia, separate from Australia and begin to move to their present locations
50-60	India separates from the Seychelles Islands
40-50	Australia separates from Antarctica
40-45	India collides with Asia forming the Himalaya Mountains
10	Australia with southern New Guinea arrive at present location
1-3	Mount Kinabalu in Borneo is formed.

This is all well and good but what does it really have to do with *Nepenthes?* I hope to make this point a little clearer as I proceed but this time/event chart serves well as a guide as we go through 160 million years of earth history.

Nepenthes, as beautiful as they are, are a primitive group: by that I mean their reproduction and seed dispersal methods are not very advanced. Unlike the more advanced flowering plants, which are bisexual, *Nepenthes* are unisexual having male and female plants. Unisexuality insures a greater genetic diversity than bisexuality since self pollination cannot occur. Pollination in either case usually requires some third party agent like insects or wind to carry pollen from one plant to another. Bisexual plants have the possibility of self pollination thereby insuring a new generation. Unisexual plants do not have that option; thus, the unisexual *Nepenthes* must depend on male and female plants flowering at the same time and upon a pollinating agent to carry pollen from flower to flower. The *Nepenthes* flower can hardly be called attractive but other animals may find it so (beauty is in the eye. .).

Once pollination occurs and fruit is produced the next problem is getting the seeds dispersed. *Nepenthes* seeds are not aero-dynamically designed for long distance flight in the air nor light enough for forest winds to carry them far. Since most *Nepenthes* are mountain-forest plants with rather narrow vertical ranges, the odds of winds carrying a seed to a similar environment are not good. Water can carry seeds down hill but again the vertical range environment is the major survival factor. It appears that *Nepenthes* species in a particular environment are doomed to remain in that environment. *Nepenthes,* it can be said, are physically incapable of traveling far from home.

One can conclude from the above that *Nepenthes* did not effectively get where they are today by seed. The environment in which *Nepenthes* evolved acts as a trap. Only if *Nepenthes* had already evolved over 100 MYA and ridden on the continents with its environment could they have gotten so far today. Fair enough, but how did *Nepenthes* do it?

Referring to the Time/Event chart it can be seen that the flowering plants evolved, or at least their pollen was common enough to be preserved as fossils, about 135 MYA. *Nepenthes* would have had to evolve before India and the Seychelles drifted from Madagascar (100 MYA) or *Nepenthes* would not be found there. This, however, depends on where *Nepenthes* originally evolved. I believe that Madagascar was the original site but more about that later. So now we have a model to explain the presence of *Nepenthes* on Madagascar, the Seychelles Islands, Sri Lanka (which is geological part of and once connected to India) and Assam India.

How to explain the South-East Asian locations? Actually, there are two ways. The first one, proposed by Danser in 1928 and later S. Kurata in 1976, presents *Nepenthes* riding on India which collides with Asia about 40 MYA. From here *Nepenthes* spread slowly through Assam, into Burma, into Thailand, down the Malay Peninsula and so on to New Caledonia. Forty million years would be long enough for the trip so time is no problem. The water barriers in South-East Asia are no problem either since the seas are shallow and sea level has fluctuated quite a bit in the past forty million years. What are now seas were once dry-land bridges connecting islands and the mainland together. This ties things together but this theory still has its problems.

First, how did *N. vieillardii* get from New Guinea to New Caledonia? Geologically New Guinea and New Caledonia probably have never been closer than 1000 miles. A land bridge has not existed between the two for at least 80 million years. What few islands that exist between them are far apart and do not have any *Nepenthes* species growing on them. The next problem is trying to explain the absence of *Nepenthes* in the Burma area. One explanation is that *Nepenthes* once lived in Burma but are now extinct. Another is that they have not yet arrived.

I propose the following model. *Nepenthes* evolved around 120 MYA in the Madagascar area of Gondwandaland. This gives them enough time to spread into the Seychelles, Indian

and Sri Lankan areas. As noted above, these areas had already split from Australia, which at that time included part of New Guinea and New Caledonia with dry land between them. During this time several now-submerged marine plateaux were elevated between Australia and Madagascar so plants and animals could still migrate for several million years. If this is true, by 80 MYA *N. vieillardii* must have already evolved in order to exist in two widely separate locations. The ancestor or ancestors were probably low-land species similar to *N. mirabilis* from which other highland species evolved. So according to this model *Nepenthes* is already migrating across a large area including parts of Australia. By 80 MYA New Caledonia splits from Australia and starts its journey to the north-east carrying *N. vieillardii* with it. Australia and New Guinea arrive and cause the formation of Northern New Guinea.

The *Nepenthes* which survived the trip across the equator were probably mostly highland species since high mountain environments would not change as drastically as the lowlands. Most of Australia became desert, save along the coast. In the mountains of New Guinea *Nepenthes* would have survived and would start to migrate from island to island and finally to the Asian mainland. This would explain the lack of *Nepenthes* in Burma since it hasn't "arrived" yet.

It may well be that the truth lies somewhere between Danser's theory and my own but one thing is for certain: The evolution of *Nepenthes* is still going strong. A classic example is Mount Kinabalu in Borneo. The mountain is a slab of granite that forced its way through the Crocker Mountain range by the forces that moved the continents. In fact, it was the collision of the Australian plate with the Pacific plate that formed the mountains in the first place beginning 30 million years ago. More to the point is that Mount Kinabalu is only a million years old. Since it has endemic species *(N. burbidgeae, edwardsiana* and *rajah)* it is safe to assume they are not as old as the mountain they live on. It's probably a good deal less since Kinabalu had an ice cap on its summit during the last glacial period 10-20 thousand years ago. The ice would have depressed the vertical ranges and environments of *Nepenthes* during that time and would have placed a great deal of evolutionary stress on the genus.

The preceding discussion is just a very brief overview of a very complex series of event which changed and is still changing the surface of the earth and its inhabitants. Plate tectonics and continental drift explain many of the mysteries of *Nepenthes* distribution and could be applied to other groups of carnivorous plants such as *Drosera.* In any case, I find it fascinating that a contemporary of the dinosaurs can be not only a source of pleasure, but also serve as a guide to a world forever lost in time.

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Kurata, S., *Nepenthes* of Mount Kinabalu, Sabah National Parks Publications, No. 2, (1976).

Wegener, A., The Origins of Continents and Oceans, 212 pp., Dover, London, (1924).

Want Ad

Tom Gibson (Dept. of Botany; 132 Birge Hall; University of Wisconsin; Madison WI 53706) (Wants pure yellow trap form-no red of *D. muscipula* and pure yellow flower form of *S. leucophylla* (no red in traps).

COMMENTS ON SARRACENIA IDENTIFICATION SHEETS

by Donald Schnell
(Rt. 1, Box 145C, Pulaski, VA 24301)

Having worked with Sarracenias in some depth for several years, I have been asked to comment on the identification sheets intended as part of a CITES manual and which appeared in the June, 1987 CPN (16:31-36 and back cover). It is my understanding that the drawings were prepared by a contracted artist from herbarium material and that the text was done by members of the Smithsonian Dept. of Botany and TRAFFIC (U.S.A.) and that the manual is intended for identification training and reference by CITES ports of entry inspectors.

I first read the text material in January, 1985 when drafts were sent to me by TRAFFIC (U.S.A.) for review and comment. I first saw the drawings after publication in CPN. My comments at the time in 1985 were somewhat guarded and dubious since I pointed out that quite simply anyone interested in smuggling Appendix listed Sarracenias would simply have to trim all pitchers and flowers and send rhizomes under the name of some non-threatened species, eg *S. alata.* The shipper and receiver would make prearrangements by letter for the code labeling. This may seem somewhat cynical, but that is the way it would be handled. Having reread the text and seen the drawings, I am still quite dubious.

I do indeed support the concept of preserving our endangered flora, although I still tend to believe that the best avenue of approach is to purchase or receive as donations large blocks of appropriate land where the endangered flora grows through some agency (preferably private, such as Nature Conservancy which has made giant strides in this direction) and then managing the property on the advice of experts on the spot, and provide security. As it stands, CITES is already way ahead of the U.S. threatened and endangered species program, and interstate shipment of certain CITES appendixed plants legally within the United States is still permissable. I think that from a practical viewpoint we need to direct precious funds and energies to the realities of preserving such sites, not the forlorn hope that ports of entry inspections will prevent smuggling of those remaining endangered species not on preserved properties.

That having been said, and the likelihood that the CITES plan and manual will proceed on course anyway, here are some observations. The concept of using botanical style drawings rather than photographs is excellent since the artist can emphasize certain characteristics in a drawing that would require several photos to show. Of the three drawings, that of *S. rubra* ssp. *jonesii (S. jonesii)* is the best in relative terms. The tall, narrow pitchers with adaxial bulging near the tops is true. One phyllodium is shown, but the leaf dimorphism should have been included more extensively with typical spring leaves along with the summer. Also, the flower drawing is limited in that the petal shape is far from correct, the petal lobe being nearly circular in all *S. rubra* sspp. (or "complex"). The flattened hood portion means little. The rhizome is also incorrectly directed and shaped. Quite frankly, the pitcher drawings of *S. oreophila* and *S. rubra* ssp. *alabamensis (S. alabamensis* ssp. *alabamensis)* are nearly indistinguishable if viewed unlabeled, except that the phyllodia on *S. oreophila* are more nearly correct. Even here, the phyllodia should be more sickle-shaped (falcate, as in the technical description—The non-technical description lists oreophila's phyllodia as "Sword-shaped," which they are not unless we are referring to a scimitar!). Again, the rhizomes are limited in their depictions. I keep mentioning the rhizomes since this is clearly the only thing most inspectors will see of these plants in ports or entry, and perhaps accurate drawings of the three or so forms of *Sarracenia* rhizomes should be made from good material, particularly if "most" Sarracenias and their natural hybrids do appear on Appendix II. Also

again, in the *alabamensis,* spring leaves (at least a wreath of a few) should be shown. Another "also," the petals of *alabamensis* are incorrectly portrayed, especially in the isolated close-up in the lower left hand corner.

Concerning the text, I am not sure what purpose the somewhat editorial comments serve an inspector regarding straight identification. The inaccuracy of the classic falcate phyllodium in the non-technical portion of one sheet has been mentioned, even though it is correct in the technical part. Concerning *alabamensis,* there are far more than 500 plants in six colonies—I found that many in northern Autauga Co., AL alone last year! Driving up and down roads is not going to lead to locations unless one is familiar with the kind of geography in which the plants are likely to occur in back areas of farms and commerical timber property. Contacting local residents for at least preliminary information may be valuable, but eventually sites must be checked by personal visits or one must see some material in the form of a plant or some leaves. (One lady enthusiastically replied to my queries and led me to a lovely stand of *Hexastylis* sp. which she thought was a "pitcher plant"!). The point is that in my experience careful searching has not expanded the range beyond the three counties known but has disclosed many more sites within these counties, some of rather great extent. One in particular extends along a rim of seeps above a creek for at least 50m. The growth of plants in this location was considerably enhanced by recent timber cutting.

Finally, I must comment on nomenclature. I realize that the CITES Secretariat has decided what names to use for members of the *S. rubra* " complex," probably based on the Case paper preceding mine. However, the concept of *S. rubra* with five subspecies seems to have caught on more in some circles. I invite readers of this article to review the papers concerned and listed below and decide for themselves. I was misquoted by the writers of the sheets—*S. rubra* ssp. *alabamensis* is not interpreted by me as a "shade variant," presuming shade in terms of light. The semispecies comment is correct, and I used the subspecies nomenclature simply because the ICBN makes no provisions for the more useful and fluid evolutionary concept of semispecies. In the end, taxonomy comes down to one's own interpretation of where the point lies for sufficient discontinuity of characters, particularly related to well-accepted species within a genus, to draw the line for species or subspecies. The Cases did a thorough and excellent study with a fine paper at the end, but our interpretations of similar observations along with a few differing observations led us to separate decisions.

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Case, F.W. and R. Case. 1976. The *Sarracenia rubra* complex. Rhodora 78:270-325.

Schnell, D.E. 1977. Infraspecific variation in *Sarracenia rubra* Walt.; Some observations. Castanea 42:149-170.

----- 1978. *Sarracenia rubra* Walter: Infraspecific nomenclatural corrections. Castanea 43:260-261.

----- 1978. Systematic flower studies of *Sarracenia* L. Castanea 43:211-220.

----- 1978. *Sarracenia* L. petal extract chromatography. Castanea 43:107-115.

----- 1979. *Sarracenia rubra* Walter ssp. *gulfensis:* A new subspecies. Castanea 44:217-223.

Want Ad

Lee's Botanical Gardens, 12731 SW 14 Street, Miami FL 33183 W: *N.* x *tiveyi, N.* x *oisoensis, N.* x "Henry Shaw," *N.* x *wittei.*
TS: *Cephalotus, S. rubra wherryi*-yellow flower, *N. truncata, N. petiolata, N. vieillardii, S. flava atropurpurea, S. rubra gulfensis gigantea,* "Okee giant" *S. minor, "Psitt* x *Flava"* and many more-free list.

Literature Review

Casper, S.J., On *Pinguicula lignicola,* an epiphytic heterophyllic member of the *Lentibulariaceae* in Cuba. Plant Syst. Evol. 155(1-4): 349-354 1987.
The author describes some new morphological features and a detailed description of the heteromorphic habit of the epiphytic species, *P. lignicola* and its relationship to *P. casabitoana* from Espanola.

Cheek, M.R. 1987. A new species of Drosera from South Africa. Kew Bulletin 42(3): 738. *Drosera slackii,* named after Adrian Slack, is herein described. The species somewhat resemble *D. cuneifolia* but is distinct in leaf and flower characteristics. The plant was discovered somewhat serendipitously when sent to Slack from a source in South Africa and listed by him in his Marston Exotics catalog as "D. sp. 'Highland Red'". The range is somewhat limited but it is locally abundant along stream margins at 500-700 m within 1 mile of the sea in Cape Province.

Outenreath, R.L. & M. Dauwalder, Ultrastructural and radioautographic studies of the digestive glands cells of *Drosera capensis:* II. Changes induced by stimulation. J. Ultrastruct. Mol. Struct. Res. 95(1-3): 164-174 1986
When stimulated, the digestive gland cells change in cell wall morphology, and secretory activity increases dramatically. Using a form of radioactive sugar called galactose, there is a selective activation of a specific population of cells in the digestive gland with the Golgi apparatus primarily involved in this activation.

Stauffer, R.T., Cytochemical tests of acid phosphatase secretion by carnivorous plants. Proc. Rochester Acad. Sci. 15(3): 181-185. 1985.
Using an azo dye biochemical test for acid and alkaline phosphatase, the author showed that heavy staining occurred in gland cells and in some interior dorsal epidermal cells. Positive results for acid phosphatase were demonstrated in *Sarracenia purpurea, flava* and *Utricularia cornuta, minor* and *vulgaris.*

Strid, A., New species of *Beaufortia* and *Chamaelaucium, Drosera* and *Pultenaea* from SW. Australia. Plant Syst. Evol. 155(1-4): 339-348 1987.
The author describes a new species of *Drosera, D. rechingeri* from collections taken from SW. Australia.

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Chas. Powell (2138 Harrison St., Santa Clara, CA 95050) (Trade or sell) Rooted cuttings: *Nepenthes alata, N. ventrata,* and various hybrids (in short supply) $10 ea; *Drosera capensis* $2.50 ea; *Sarracenia leucophylla, S. alata* $4 ea; large *Darlingtonia californica* (limited supply) $15 ea; *Pinguicula* x *Weser* large $5, small $3 ea; *P. esseriana* $3 ea; other *Pinguicula* in limited numbers, write for list. (Want, Trade or Buy) *Drosera affinis, D. esmeraldae, D. felix, D. insolta, D. panamensis, D. pilosa,* any *Genlisea, Pinguicula crenatiloba, P. cyclosecta, P. lilacina, P. ramosa, Utricularia endresii, U. erectiflora, U. jemesoniana, U. nelumbifolia, U. spiralis, U. volubilis, Nepenthes bellii, N. clipeata, N. leptochila, N. pilosa, N. tentaculata.*

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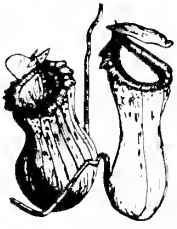

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